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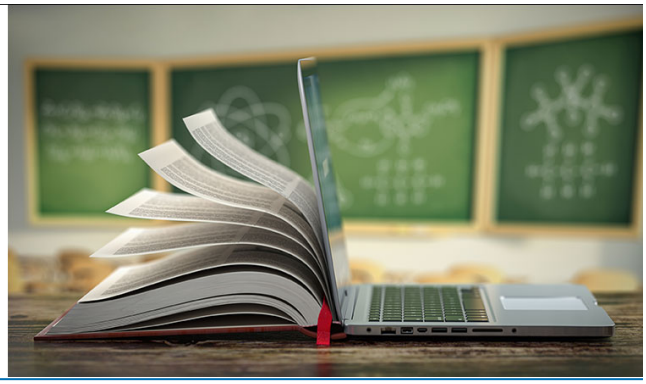

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To the problem of organization and design of psychoneurological complexes for children in the context of modern architecture

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Abstract. The article is devoted to the functional organization of complexes of children's specialized clinics. It is noted that mental health is one of the main parameters of the population, which largely determines the present and future development of the world community. The main reasons for the growth in the number of mental disorders in the modern world, including those relevant to Russia, are listed. Statistical data, main social-economic and ecological factors, modern requirements and tendencies of development of a network of medical institutions, expediency of their use in approaches for designing of children's neurological clinics are outlined. The role and contribution of modern architecturally-building practice in process of development of this social sphere and special problems facing designers are emphasized. The authors have considered typological analogues from modern foreign architectural practice. In the analysis, along with the solution of the main technological problems, a unified approach in the organization of both internal and external spatial environments that promotes social, environmental, psychological rehabilitation and healing of patients is proposed. A conceptual model of a children's psychoneurological clinic, which offers not only the creation of a functionally reasonable, constructive and technologically literate structure, but also the active inclusion of social and recreational spaces and natural components in interaction with the surrounding landscape, is presented. The goal of the project was to create a model of "internal city" in which patients, staff and parents would feel comfortable not only physically but also psychologically.

1. Introduction

The development strategy of modern society should ultimately aim for the highest possible level of quality of life and health as one of the most important conditions for the formation of a viable and balanced social environment. Among the most acute problems of modern medicine and health care according to official statistics [1-3], there is an increase in neurological diseases. "Mental health is one of the parameters of the population's state. It is generally accepted to assess the state of mental health by indicators characterizing the prevalence of mental disorders." [4-6] The World Health Organization (WHO) predicts that in the near future mental disorders will become one of the top five diseases leading to disability.

According to the world's leading experts, the main reasons for the spread and growth of mental disorders in today's world are [7,8]:

- urbanization trend and increasing population density;
- ecological state of the natural environment and related risks;
- technogenic factors;
- continuously increasing flow of information and complexification of technologies.

The above reasons are fully relevant for Russia. "According to WHO, children and adolescents with various mental health problems account for approximately 20% of the total number of children and adolescents", according to statistics in 2005 [9,10]. "the percentage of children in the total number of mentally ill, who for the first time in their lives were recognized as disabled, increased from 25.5 to 28.4%". [11,12]

In addition to general factors, the increase in the prevalence of mental and behavioural disorders in childhood and adolescence is also caused by:

- intensification of psychogenic load due to the complication of the school education, which is not always adjusted to the cognitive abilities of the child;
- problems with social adaptation in the school community;
- modern medicine limitations in providing complete recovery for children with congenital pathologies [13,14].

The state of physical development of children and adolescents, as an essential social aspect, determines the health of the population in older age, its potential longevity and the transfer of these qualities to future generations. This is the "intellectual potential of the nation, labor resources and moral climate in society, which generally determines the level of social well-being and sustainable development of society. One of the leading areas of activity of the Russian health care system is the protection of children from psychoneurological diseases, prevention and treatment in this area of medicine and resource endowment, including facilities provision.

2. Architectural example

Architecture, being an integral part of all spheres of human activity and a vector of development of society as a whole, is aimed to solve professional tasks connected, in this case, with creation of modern medical and rehabilitation centers. In particular, one of the most relevant tasks today is to design a neurological clinic for children and adolescents. Efficient planning and organization of psychological and psychiatric services requires special attention of designers to the organization of architectural environment. The viability of such an environment in the modern approach depends on seemingly contradictory at first glance, but extremely necessary in the particular building context solutions:

- simultaneous centralization and decentralization;
- security and openness;
- freedom of movement and easy monitoring;
- privacy and socialization.

This is how the project for the building of a psychiatric clinic (2003-2006) in Elsinore, Denmark, was conceived and implemented (figures 1,2). The concept rejected traditional image of a closed "sick bay", instead offered the creation of an internal "city of joy", a balanced system based on the collaboration of architects, employees, patients and their relatives. [15]. Thus, the organization of interior glazed courtyards and galleries provided visual integration of natural environments and a full-fledged natural lighting of long corridors allowed to meet technological requirements and at the same time create abnormal "architectural" space for clinic.

The participants of the "New Hospital in North Zealand" competition for Denmark, announced in 2013, were not only challenged with functional and aesthetic tasks, but also with establishing the conditions for communication and positive mood of patients, which is also important for recovery [16]. The project of the workshops BIG, WHR Architects, Arup, ArchiMED, Man Made Land and

Topotek 1 presented the concept of a "healing" space - a complex of eight buildings arranged on a plan in the form of intersecting rings with the inner courtyards (figure 3). Integration of green courtyards into the general composition of the complex, visual connection to the surrounding landscape, provision of rooms with sunlight, "personal garden" for communication and walks: all these techniques are conditioned by the functional necessity in the context of the main purpose of the building [17].

Figure 1. Elsinore clinic: general view.

Figure 2. Elsinore clinic: courtyard.

The winner's project from Architectural Bureau Herzog & de Meuron also pays much attention to the interaction of the building with the surrounding landscape and the integration of natural components in courtyards and green galleries. The focal point is the central public space that connects the courtyards and is dedicated for all participants: patients, doctors and visitors (figure 4).

Figure 3. New Hospital in North Zealand (the project of the workshops BIG, WHR Architects, Arup, ArchiMED, Man Made Land and Topotek 1)

Figure 4. Central public space (the project of the architectural firm Herzog & de Meuron)

The competition "New Hospital in Northern Zealand ", along with the solving of complex functional and technological problems, reflected modern trends in the design of medical facilities: a low-rise building as a contrast to large medical complexes, openness and freedom of movement, spatial socialization and environmental integration (figure 2, top). "We are happy to win this competition as the choice of a project like ours promises to open a new page in the cooperation between architecture and healthcare", said Herzog & de Meuron in an official press release.

3. Case study: Children's neurological clinic project in Ekaterinburg

The address to this topic was developed in the research project "Children's Neurological Clinic in Yekaterinburg" by teachers and students of the Architecture Department of the Institute of Construction and Architecture of Ural Federal University. Architectural design was preceded by a detailed analysis of typological analogues, for example children's clinics, which include a specialized institution and a hospital. This involves taking into account a number of social, pedagogical and medical factors that determine the modern development of this area of architectural typology.

On the basis of the research and as a project approbation of the topic, a conceptual model of the complex was proposed. A site with good transport accessibility and, at the same time, in a quiet and picturesque location in forest park area of Yekaterinburg was chosen.

The development of a model of a children's psycho-neurological clinic for ages 0-14 was intended to solve a number of problems:

- room differentiation according to patient's age;
- organization within the medical complex;
- organization of the educational block as a part of the complex;
- organization of the block for the possibility of living of parents;
- ensuring the comfort of the indoor environment;
- accounting of bioclimatic and natural-landscape conditions;
- integrate the building into the environment through low-rise constructions.

The multifunctional special structure of the complex implies the main technological blocks: health and medical, residential and educational. The blocks are formed taking into account the age groups of patients (preschoolers and pupils) and are supplemented by catering complexes and apartments for possible residence of parents (figure 5). An important role in the design solution is given to public spaces - recreational areas and an atrium with a winter garden for meetings and socializing. The planning structure of the complex provides: clear vertical and horizontal zoning of the main blocks and groups of premises, possibility of their autonomous operation, separation of the main service flows and patient flows, while maintaining all the necessary communication elements and utilities within both individual technological blocks and the complex as a whole (figure 6).

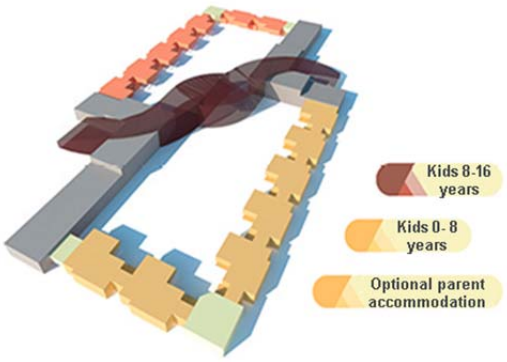

Figure 5. Hospitalization scheme of the complex.

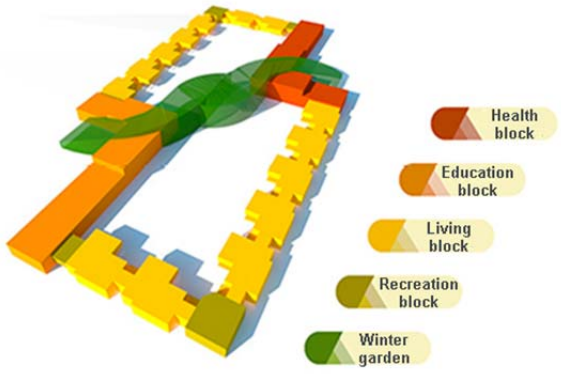

Figure 6. Functional schemes of the complex.

4. Volume-planning and design solution of the complex in Yekaterinburg

The compositional solution of the complex is a closed perimeter building, which forms an internal open space divided by a central public and recreational atrium into two courtyards according to the zoning solution of the complex to accommodate different age groups of patients. This made it possible to avoid the sadly traditional enclosures of such buildings with fences or walls. The atrium is not only a design core and space for integration of the natural landscape, but also a bright accent in the volume composition of complex architecture. In addition, the atrium space performs the tasks of the

ecotechnical concept of the interior space. The organization of spacious inner courtyards allows maximizing the use of the natural potential of the landscape: preserving and integrating the existing trees into the surrounding area and compensating lost during construction natural components. The structural solution of the site is based on a combination of framework systems that depend on the functional purpose of the blocks: residential blocks are made in a wooden frame with outer walls made of wooden sandwich panels, medical and training blocks in a monolithic reinforced concrete frame, central atrium space in a steel frame.

The use of frame systems provides flexibility of internal space, the possibility of internal transformation and redevelopment in the future, consequently extending the life cycle of the building.

An important component of the general idea of the complex is to address the issues of child psychology: introduction of the "game" elements interpreting the fairytale "paraphernalia", in this case the famous work of L. Carroll "Alice in Wonderland". In the overall composition, the central atrium is conceived as a "blue caterpillar," combining two mirrored parts of the plan and dividing the courtyard space into two areas. The unusual form of atrium's complex glazing creates not only a memorable, associative image and architectural aesthetics of the yard exterior, but also a unique interpretation of the inner space, where a fairytale theme could be developed in the elements of interior, furniture and interior decoration.

Special attention was paid to the parameters of the internal environment to ensure comfortable living and training, medical services, communication and recreation. An important design factor is compliance with bioclimatic factors: insolation, natural light, natural ventilation. For this purpose on the roof climate and technical systems (firms "Remak", McQuay", "Daiki") in soundproofing version are installed, as well as mechanical systems to protect against overheating in the atrium. Insolation of the main premises for accommodation, medical care and study of patients, as well as the territory of the yards is provided by the meridional orientation of the object in accordance with regulatory requirements (figure 7). This has a positive effect on the well-being of the patient and has a good impact on the recovery of patients.

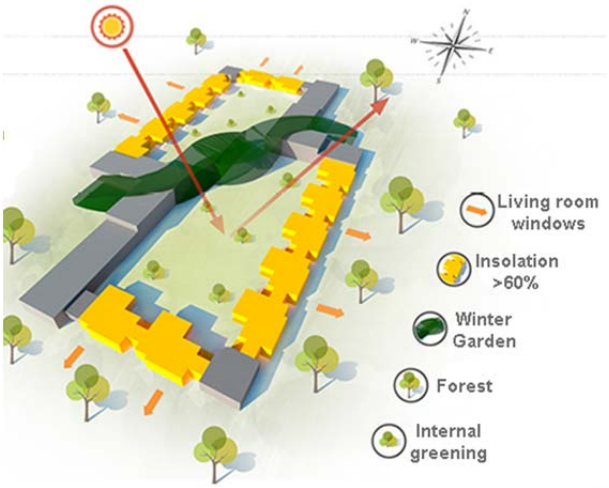

Figure 7. Scheme of comfort parameters of the complex.

5. Conclusion

The goals and tasks of architectural design in the organization of complex children's psychoneurological clinics for children and teenagers are, first of all, the development of a functionally reasonable and technically appropriate design, corresponding to its purpose, volumetric planning solution, which would take into account age differentiation of patients and the division of the flows of people. An effective system of interconnections, optimal freedom of movement and safety must be established. Particular attention should be paid to the image of the building, the colour scheme

of the facades and the organization of public and recreational spaces with an interior landscape in relation to the environment, which has a positive impact on the psycho-emotional state of children and adolescents (figure 8).

Figure 8. Complex facade.

The proper organization of treatment and care ensures the social adaptation of patients in the future, with subsequent and more active integration into the public environment. And here much depends on the further development of this area in modern architecture.

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